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(54) IMPROVEMENTS IN OR RELATING TO CYCLONE SEPARATORS

(71) We, ROLLS-ROYCE LIMITED, formerly Rolls-Royce (1971) Limited of Norfolk House, St. James's Square, London, a British Company of 65 Buckingham Gate, London, SW1E 6AT, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to cyclone separators of the straight through type in which dust laden gas enters the separator axially at one end and the cleaned gas and separated dust leave the separator axially at the opposite end.

According to the present invention there is provided a cyclone separator of the straight through type, in which dust laden gas enters the separator axially at one end and the cleaned gas and separated dust leave the separator axially at the opposite end, comprising a housing having an inlet, a central boss located in the inlet, flow swirling means located in the annulus between the housing and the central boss, boundary layer fences located downstream of the flow swirling means on the downstream face of the central boss, a central duct for the exhaust of cleaned gas and an annular duct surrounding the central duct for the exhaust of separated matter, the boundary layer fences comprising wall-like projections extending into the interior of the housing.

The boundary layer fences may be in the form of rings mounted on the base of the central boss.

The present invention will now be more particularly described with reference to the accompanying drawing which shows an elevation of one form of straight through cyclone according to the present invention.

In the drawing, a straight through cyclone 10 comprises a circular housing 12, an annular inlet 14 defined by a central boss 16 and the housing 12, a ring of swirler vanes 18 and a swirl chamber 19. The central boss 16 has a flat base 18 on which are mounted boundary layer fences 20 and 22 which are circular and differ in depth from each other.

A central duct 24 is located downstream of the boss 16 for the exhaust of cleaned gas and is surrounded by a further annular duct 26 defined by the housing 12 and the central duct 24 for the exhaust of separated matter down the annulus 26. The duct 24 is tapered in the direction of flow and prevents separated matter from re-circulating and entering the central duct 24.

In operation, particle laden gas enters the housing 12 through inlet 14 and is swirled by the vanes 18. The swirl velocities increase (by constant angular momentum) as the gas approaches the centre till a small central core rotating at constant angular rotation is reached, (at about one quarter of the radius of housing 12).

The friction of the gas on the housing 12 produces a slowing of rotation of the gas where there is a large surface area in relation to the massflow of the gas, particularly in the narrowing gap between the lower parts of annular duct 26, and therefore the centrifugal head difference between inner and outer radii is lower than in the unobstructed centre of the swirl chamber 19. Therefore air will flow axially down into this annulus 26 from the vanes 18, with swirl, and then move radially inward in the annulus, and then vertically upwards into the middle of the swirl chamber and then downward through duct 24. Particles will thus be carried by the gas into this annulus, be gradually centrifuged out of the gas towards the wall and be swept to the bottom of the annulus and be exhausted at the narrow gap between the duct 24 and the housing 12.

A similar air friction effect arises on the flat end 18 of the central boss 16, so a secondary swirling flow can carry particles inwards to the core, bypassing the main swirl separation. The boundary layer fences 20,22 are fitted where the slowed down air creeping inwards in a spiral along the face of the base 18 to the centre is forced out by the continuous circular fences to bring this slow moving air into close proximity with the more rapidly swirling air in the upper parts of the swirl chamber 19. This swirling air mixes with the slower air, and re-energises it so that particles

held in this slower air can be centrifuged out into the higher speed whirl and so be transferred to the inner surface of the housing 12 and thence to the duct 26.

WHAT WE CLAIM IS:—

1. A cyclone separator of the straight through type, in which dust laden gas enters the separator axially at one end and the cleaned gas and separated dust leave the separator axially at the opposite end, comprising a housing having an inlet, a central boss located in the inlet, flow swirling means located in the annular between the housing and the central boss, boundary layer fences located downstream of the flow swirling means on the downstream face of the central boss, a central duct for the exhaust of cleaned gas and an annular duct surrounding the central duct for the exhaust of separated matter, the boundary layer fences comprising wall-like projections extending into the interior of the housing.

2. A cyclone separator as claimed in claim 1 in which the boundary layer fences comprise two or more rings mounted on the base of the central boss.

3. A cyclone separator as claimed in claim 2 in which the outermost ring comprises an extension of the outer wall of the boss beyond the downstream face of the boss.

4. A cyclone separator as claimed in claim 2 or claim 3 in which the outer ring is greatest in depth of the rings.

5. A cyclone separator of the straight through type constructed and arranged for use and operation substantially as herein described with reference to and as shown in the accompanying drawing.

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and
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1 SHEET

COMPLETE SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale